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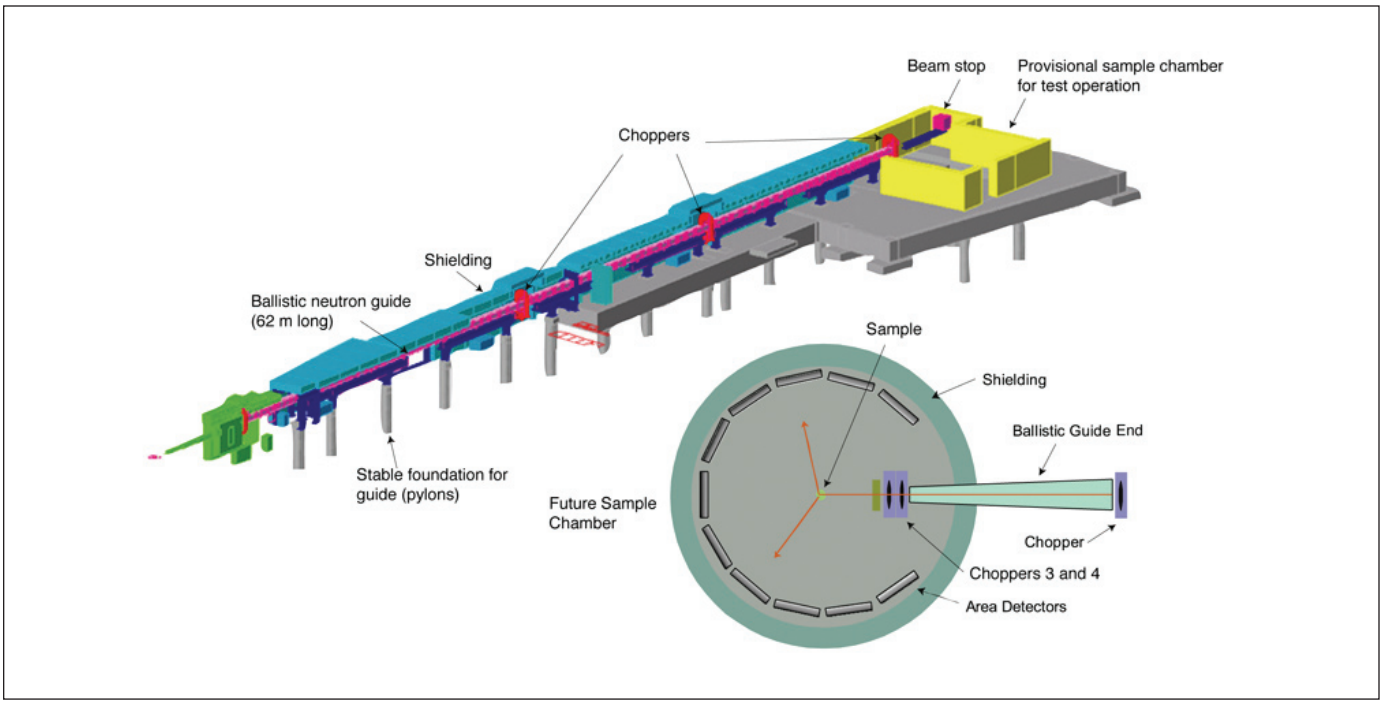
Inelastic Cold Neutron Spectroscopy (IN500)

Neutron scattering is used by a worldwide community of about 7000 physicists, chemists, engineers, life scientists, and geologists as an important tool in condensed-matter research. Currently, the majority of this work is performed with research reactors as neutron sources. Spallation sources play a complementary role, with reactors offering superior neutron beam performance in 70% of the experiments. Further progress in neutron-scattering research depends on our capability of making spallation sources first competitive, and ultimately superior, to reactors in core applications in which reactors provide much superior performance over spallation sources. This revolution in neutron-scattering science is the challenge of the next decade. LANSCE made the first major step in this revolution by installing the first coupled moderators, which can produce 6 to 8 times more useful neutrons for the same driving proton beam power than those used at other leading spallation sources. This high neutron intensity comes in long pulses with significant intensities up to 3 to 4 ms from the beginning of the pulse. The IN500 Laboratory Directed Research and Development project at LANSCE is developing a series of novel approaches specifically conceived to establish the use of these long pulses–mechanical pulse shaping, repetition rate multiplication, and enhanced neutron optical beam extraction and delivery system. Implemented on the novel, coupled H_2 moderator, these techniques will, for the first time, open up the way for spallation sources to surpass the capabilities of the most advanced reactor facilities in one of their core competencies–cold neutron spectroscopy. IN500 provides a crucial research tool for the study of soft and complex matter, including collective phenomena in polymers, biological matter, soft metals such as plutonium, liquids, and nanostructured matter.



Specifications	
Moderator	Coupled liquid H_2, FP13
Moderator-sample distance	63 m
Sample-detector distance	3 m
Wavelength definition choppers	at 7 m, 20 Hz at 31.5 m, 20 Hz
Resolution definition/ pulse-shaping choppers	at 31.35 m, 480 Hz (counter-rotating discs) at 62.5 m, 240 Hz (counter-rotating discs)
Pulse-filtering chopper	at 46.87 m, 320 Hz (single disc)
Ballistic guide	starts at 1.2 m, 61.3 m long
Detectors	10 m^2, pixel at 2 x 2 cm^2
Incoming wavelength range	2-20 Å
Resolution	adjustable, e.g., 15-50 μeV at 7 Å incoming wavelength